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## COURSES IN THE TEACHING OF NATURAL SCIENCE IN THE COLLEGE OF EDUCATION.

THE courses in natural science offered in the College of Education are intended distinctly for those who desire professional training as teachers. They all assume, at least, that degree of academic knowledge of subject-matter on the part of the student which will enable him to grasp with some clearness the inter-relations of the great subdivisions of science. They also presuppose that maturity of mind and experience on the part of the students which will enable them to take up with intelligence the study of the relations of the various subdivisions of subject-matter to the needs of pupils ranging from the kindergarten to the college.

Careful personal inquiry, therefore, rather than a formal examination, will be made into the merits of each case, with the purpose of determining what course should be taken, and with a view, also, to finding out what further academic preparation, if any, may be necessary.

To this end, the various courses are planned as consistent parts of an organic whole. In Course A, intended for high-school graduates, two and one-half science courses are prescribed. In Course B, intended for those who, in addition to a high-school course, have two years of college work to their credit, one and a half science courses are required. Just what these courses shall be will be determined in each case by the previous preparation and experience of the pupil. They will be chosen also with a view to forming proper relationships with the other subjects or any special course that the student may be pursuing. The courses, in addition to those required, are offered as electives. They are intended to give further training to those who desire to prepare themselves for special work in the grades, either as teachers or supervisors, or who may be preparing to teach science in high or normal schools. In the courses offered, an effort has been

made to develop a plan of teaching as a whole which shall be in accordance with the principles of psychology and pedagogy. So far as this is true, the plan should also meet the practical needs of the pupils for a knowledge of nature in their daily living. The earlier courses are devoted to an investigation of the general experience which children acquire in their direct contact with nature. While this experience is vague and lacking in detail, it is nevertheless well ordered and consistent. Nothing could be farther from the truth than to suppose that the mind of the child is in a state of confusion as regards the facts and phenomena of nature. It is true that the reasons for things observed are not distinctly formulated in the young mind, but there is nevertheless a general appreciation of natural causes which renders the nature-picture rational.

The preliminary courses, therefore, deal with those larger aspects of nature with which children at first become acquainted. The field work involved in Course 81 is directed toward a study of the region, considered as a whole, which lies adjacent to the school, and which depends for its character upon its antecedent and present relations to glacier and lake. It further involves a study of the causes which have led to a subdivision of this entire area into smaller units, each of which has something of a distinctive character of its own. Collections of specimens of soil, rock, plants, and animals are made in sufficient quantity to enable the pupils to make an intelligent comparison between the areas, one with another.

In Course 82 some particular area is selected for a more detailed study. An effort is made to discover the nature of the general and special problems which must be solved by the animals and plants that are found. This leads to a study of the temperature of the air and of the soil at different depths; to a study of moisture—rainfall, quantity of water present at different times and depths in the soil and in the air; to a study of sunshine distribution in the various seasons and at different hours in the day. The various problems are worked out to definite and quantitative results from observations and measurements made

on the grounds and by the necessary experimental work in the laboratories. Collections are made, and attention is given to a general consideration of questions of adaptation and structure.

Courses 83 and 84 pursue in greater detail a study of the subjects derived from those preceding. Course 83 deals especially with the biological aspects of nature study, and it involves such work in dissection as may be necessary to acquaint pupils with the gross internal structure of those forms of animal and plant with which they have been made familiar in a general way by previous study. The aim is to assist the students in the development of a plan for giving their future pupils an intelligent idea of the great functions and chief structures of the animal and plant bodies, thus laying a proper foundation for physiology and hygiene and general biology.

Course 84 seeks to develop a plan for introducing the pupils directly to some of the more obvious relations between the organic and inorganic divisions of nature. It includes a general study of the more easily determined physical and chemical properties and constituents of minerals, soils, and plants; also a study of such problems in heat, light, sound, electricity, and mechanics as have obvious bearing upon human life and welfare.

Course 87 deals with special experimental work of a historic character which will throw light upon the development of modern appliances found in human industries at the present time.

Course 85 is historical in character, and is based upon observation, readings, and lectures. Such works as those of Darwin, Huxley, Haeckel, Spencer, White, and others are used as references, with a view to giving the student a general view of the development of scientific conceptions as they stand at present. An attempt is also made to work out some of the more important bearings that these conceptions have upon the social, economic, and moral questions of the day. This is done in the belief that the training of a teacher is not complete unless special attention is devoted to a study of the principles of evolution as applied to the development of character in youth. Teachers are but beginning to recognize that physical development is a process of evolution;

they do not as clearly recognize that conduct is the result of the same slow process. This course, therefore, is devoted mainly to the organic and necessary relations which the study of nature bears to character as the true and safe basis for conduct.

Course 86 is devoted mainly to the broader pedagogical relations of science. One of the great obstacles in the way of the introduction of the study of nature into the schools is the feeling that in some way it will result in driving out of the curriculum, or at least in weakening, the work of some of the studies admitted to be essential. Although the history of the nature-study movement for the past ten years shows that this fear is not only groundless, but that nature study actually demands more and better work than ever before in other related subjects, the task of properly correlating all the subjects in the curriculum has not been clearly understood. This course will involve, therefore, a history of the movement, a consideration of a proper evaluation and place of studies, and a study of the changed and changing conditions made necessary by the great influx of new subject-matter that has recently come into the schools.

Corresponding to the broad presentation of subject-matter contemplated in these courses, there will be the same careful attention given to the various modes of expression. The different modes of expression are the recognized means whereby the image roused by presentation is limited and defined. The students will, therefore, be called upon for such work in drawing, painting, modeling, making, and writing as may be necessary properly to develop the subject with children. Observations will be constantly supplemented by reading, and due attention will be given to the selection of reading matter of an appropriate character. Number and form will be employed also from the beginning, in the determination of natural quantitative relations. The proper use of the latter subjects is absolutely necessary in the development of some of the most striking and beautiful of nature pictures. Their long isolation from the subjects in the curriculum and from the practical affairs of life, together with the blind devoteism of most teachers to endless drill upon empty processes,

renders it extremely difficult to get students to study intelligently the relations of mathematical subjects to the necessities of image growth. It is small wonder, then, that while these conditions last it will be difficult to detect any improvement in subject-matter and in methods of instruction in these branches when such students become teachers.

In addition to the field and class-room work required in the various courses, opportunity will be offered for judicious observation and teaching in the elementary and high schools under careful supervision, counsel, and criticism. A considerable amount of time will be given to a consideration of this aspect of the teachers' preparation by round-table and seminar methods. This phase of the work, which will actually constitute the laboratory exercises of the courses, will be adapted, as far as possible, to the individual needs and qualifications of the different students.

The principal test as to the value of the work accomplished by the students who take these courses will be found in the evidences that the pupil can produce to show that he is able to teach and supervise the work in nature study and the elements of natural science in elementary, high, and normal schools. These signs of the student's professional merits will be gleaned from the exercises in the class-room and field, from the skill he shows in being able to express himself clearly in discussions, from the plans he prepares as a basis of his teaching, and finally from his poise and general effectiveness as a teacher before his class. Above all else in importance stands the character of the student; and these results will all be studied, therefore, in the light of his motive. If the student be lacking in true nobility of purpose, his preparation will always be superficial, and no amount of formal training will ever develop him into what the world really needs—a conscientious and efficient teacher.

WILBUR S. JACKMAN.